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**BEFORE THE PUBLIC UTILITIES COMMISION**
**OF THE STATE OF CALIFORNIA**

# COMMENTS ON RAILROAD GRADE CROSSING PROJECT PRIORITY FORMULAE, TO BE PRESENTED AT WORKSHOP AS REQUIRED UNDER PUC DECISION 00-08-080, DATED AUGUST 3, 2000

WORKSHOP SCHEDULED FOR WEDNESDAY, DECEMBER 6, 2000
AT 10:00 A.M., IN SAN FRANCISCO

SUBMITTED BY:

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## COMMENTS ON RAILROAD GRADE CROSSING PROJECT PRIORITY FORMULA

### INTRODUCTION

At the Public Hearings on Investigation 99-07-001 held in San Francisco September 21, 1999, Robert M. Barton called attention to certain shortcomings and illogical results from application of the Commission's formulae for determining the priority ranking of railroad grade crossings "most urgently in need of separation." Mr. Barton's written comments were distributed to the interested parties on October 22, 1999.

Because of the shortage of time, it proved impractical to consider revisions to the formulae in the priority list established for years 2000 - 2001 and 2001 – 2002. However, under Decision 00-08-020, issued August 3, 2000, the Commission ordered a workshop be convened prior to receiving the nominations for the next grade separation cycle for the years 2002 – 2003. The workshop is scheduled for Wednesday December 6, in San Francisco. This document contains the comments required to be received by PUC staff by November 3, 2000.

In response to the comments Mr. Barton distributed October 22, 1999, four parties agreed that some changes should be made. Mr. Tom Glover, Railroad Agreements Engineer, California Department of Transportation, has recently offered some very constructive suggestions. Accordingly, the comments which follow largely reiterate the October 22, 1999 document, but have been revised to reflect some of the recommendations of Mr. Glover, but not necessarily his proposed formula.

### Philosophy and Assumptions

The generally accepted methodology to evaluate the comparative merits of competing grade separation candidates is to multiply the number of trains by vehicular traffic volumes– a product referred to as "V x T". However, where crossings have the same volumes of vehicular and train traffic, those that cost only $1 million each should be ranked higher than those costing, say, $2 million. Twice the benefits for the same dollar. Thus the cost is placed in the denominator of the formula.

However, other warrants should be recognized and points added as appropriate, such as delays to vehicular traffic caused by trains, number of passenger trains (more lives jeopardized if a passenger train hits a gasoline tanker than if a freight train strikes the truck), comparative geometrics of the crossings (skew vs. right angles), accident record, and other factors. Although opinions may differ as to the relative weight or number of points to be assigned to each of these secondary factors, it is convenient to add them together in an attempt to identify projects "most urgently in need of separation," the mandate of S & H Code Section 2452. This is not rocket science, but rather an effort to apply common sense in evaluating a variety of factors. A similar methodology or point system can be applied in determining the winners of a dog show or a beauty contest. The ultimate test is whether the formula which determines the outcome is consistent with common sense.

Two formulae are currently used by the California Public Utilities Commission to determine the priority of railroad grade crossings “most urgently in need of separation.” The current PUC formula, which the writer contends is defective, for separation projects to eliminate existing or proposed grade crossings is:

$$P = \frac{V\,(T + 0.1 \times LRT)}{C \times F}\,(AH + BD) + SCF$$

| | | | |
|---|---|---|---|
| Where: | P | = | Priority Index Number |
| | V | = | Average 24-Hour Vehicular Volume |
| | C | = | Total Separation Project Costs (in Thousands of Dollars |
| | T | = | Average 24-Hour Train Volume |
| | LRT | = | Average 24-Hour Light Rail Train Volume |
| | F | = | Cost Inflation Factor (based on Current Construction Cost Index) = 8.32 (as used in I-99-07-001) |
| | AH | = | Accident History |
| | BD | = | Crossing Blocking Delay |
| | SCF | = | Summation of Special Conditions Factors = VS+RS+CG+PT+OF |

(Vehicular Speed Limit, Railroad Prevailing Maximum Speed, Crossing Geometrics, Alternate Route Availability, Number Passenger Trains, and Other Factors – i.e., secondary accidents, emergency vehicle usage, passenger buses, school buses, hazardous materials on trains and trucks, and community impact.

For existing railroad separations in need of alteration, widening or reconstruction, the current formula, which the writer also contends is defective, is:

$$P = \frac{V\,(T + 0.1 \times LRT)}{C \times F} + SF$$

| | | | |
|---|---|---|---|
| Where: | P | = | Priority Index Number |
| | V | = | Average 24-Hour Vehicular Volume |
| | T | = | Average 24-Hour Train Volume |
| | LRT | = | Average 24-Hour Light Rail Train Volume |
| | C | = | Total Separation Project Costs (in Thousands of Dollars) |
| | F | = | Cost Inflation Factor = 8.32 |
| | SF | = | Separation Factors = WC +HC+SR+AS+POF+AP+DE (Width Clearance, Height Clearance, Speed Reduction, Accidents at or near structure, Probability of Failure, Accident Potential, Delay Effects) |

## Background

The formulae for computing the priority of projects to eliminate existing crossings from 1957 to 1988 usually were of the following form:

$$P = \frac{\text{Vehicles X Trains}}{\text{Cost X Inflation Factor}} + \text{Special Conditions Factors}$$

However, with the 1988 priority list, a Southern California transit district nominated several separations on light rail lines, and was awarded the eight highest positions in the entire state, based on the high frequency of light rail movements at these several crossings. The expressions of outrage from other local agencies were immediate, as evidenced by written statements of concern.

In response, the PUC scheduled hearings and invited comments from the interested parties in 1990. The issue of the light rail movements was resolved by adopting a reduction factor of one-tenth, that is, evaluating ten light rail movements as equivalent to one conventional freight or passenger train, based on testimony of the superior braking characteristics of trolley cars as compared with a 10,000 ton freight train.

## PART I - PROBLEMS OF THE PRESENT FORMULA

However, other changes were made to the formula and these changes had not been previously been tested in practice. Several grave deficiencies have subsequently come to light, and should be the subject of discussion and reevaluation of the formula at the forthcoming workshop. Examples follow:

**Priority Formula Does Not Recognize Increased Hazards Caused By Short Trains**

The present formula sometimes produces bizarre results, especially with regard to the Blocking Delay (BD) factor. Consider the following hypothetical crossing which carries only 10 long trains – no short trains -- (Column 2):

| | **Without Short Trains** | **With Short Trains** |
|---|---|---|
| Number of Long Trains | 10 | 10 |
| Average Delay Long Trains (Min) | 4.4 min | 4.4 min |
| Number of Short Trains | 0 | 10 |
| Average Delay Short Trains (Min) | — | 0.5 min |
| Total Delay | 44 min | 49 min |
| Cost of Project (Millions) | $6 | $6 |
| Accident History, 10 years (AH) | 0 | 0 |
| "F" Factor (used in 1998-99) | 8.66 | 8.66 |
| Average Blocking Delay (BD) | 4.4 min | 2.45 min |
| $\frac{V \times T}{C \times F} \times (AH + BD)$ | 8.49 | 9.43 |
| Special Conditions Factors | 20 | 20 |
| Total Priority Index No. | 28.49 | 29.43 |
| | | |
| Position on Priority List (Ranking) | **34** | **34** |

The third column in the above tabulation shows what happens if 10 short switching movements, helper locomotives, or engines running light traverse the same grade crossing, in addition to the long freights. Each of these brief movements closes the crossing for only 30 seconds, thereby adding 5 minutes to the total delay. Again applying the number of train movements, now increased to 20, and the other factors into the same

computation yields a $\frac{V \times T}{C}$ product of 9.43,and a grand point total of 29.43

This is only one point more than the same crossing with **only half** the number of train movements.

The above hypothetical example shows that even though the number of trains doubles, and the risk of accidents at the crossing also increases by a like amount, the priority index number remains almost the same: 29 points instead of 28, and the Statewide ranking on the Priority List (No. 34) does not change.

This illogical result occurred in nominations of the Greater Bakersfield Separation of Grade District in the East Bakersfield area where the bizarre effects of the BD factor deprived Kern County of a higher position on the priority lists for 1994-95 and 1995-96 than it would have received under the earlier formula.

The Morning Drive grade crossing east of Bakersfield is notorious for the large number and prolonged nature of delays. A long eastbound freight train climbing the steep grade towards Tehachapi Pass typically blocked traffic for three minutes or more. In ordinary circumstances, a reasonably high priority position would be expected because of these numerous long delays.

However, several helper locomotives returned daily to the BNSF and Union Pacific yards, after boosting heavy trains up the grade. These returning locomotives usually caused delays of no more than 45 seconds. However, the short trains reduced the **average** delay. In other words, an increase in the overall train count due to several locomotives running light had no impact on the priority position.

If the operation of twice as many trains through a grade crossing increases the risk of accidents and increases total delay – as conventional wisdom would suggest – should not the output from the formula show a similar conclusion? In summary, the BD (blocking delay) factor is flawed. A substantial increase in the number of trains clearly warrants a higher priority position.

<u>Alternative methods of computing blocking delay (BD)</u>.

The difference in methodology between using average delay as opposed to taking total delays and then dividing by an arbitrary constant (i.e.10) can be illustrated by the San Francisco – San Jose Caltrain line, which carries more than 66 commuter trains per day, with the gates down 40 seconds at a typical crossing.

- Average delay, if total of 44 min. divided by all movements = 0.67 minutes
- Total delay divided by constant 10 (more logical) = 4.42 minutes

For the hypothetical example cited earlier, with 10 long trains and 10 short trains, the total delay is 49 minutes per day

- Average delay, if total delay divided by all movements (20) =2.45 minutes
- Total delay, if divided by constant 10 (more logical) = 4.90 minutes

After the BD is properly computed, where should it be placed in the priority formula? The writer believes the formula should give special emphasis to delays, which vary widely from one crossing to another. Delays caused by commuter trains on the San Francisco – San Jose, Capitol, and Oakland – Bakersfield San Joaquin corridors usually extend for no more than 30 or 40 seconds – the same delay caused by traffic signals on an urban thoroughfare, which have little impact on the movement of vehicular traffic or the level of congestion. (Caltrain reports an average of seven or eight fatalities per year, with a high of 20 in 1995. Of the 15 deaths already experienced during 2000, 13 have been pedestrians and six have been suicides. However, the major cause of the fatalities cannot be ascribed to delays). At the other extreme, grade crossings at the throats of switching yards are especially troublesome. Three examples with which the writer is familiar are:

- Carson Street in the throat of the former Southern Pacific Dolores yard, City of Carson, where numerous and prolonged switching movements in and out of the Los Angeles – Long Beach Intermodal Container Transfer Facility (ICTF) blocked the thoroughfare for several hours a day. Impatient passengers sometimes would leave their stalled buses and crawl between standing freight cars to get to the other side of the crossing.

- F Street, at the easterly throat of BNSF's classification yard, Bakersfield. F Street was a north-south arterial, its north end fed by a major intersection on the Route 204 (former US 99) Expressway. However, for all practical purposes F Street at the railroad crossing became impassible, and the crossing was eventually closed, with traffic diverted to a new underpass only two blocks distant.

- Sutterville Road, at the south throat of the former Western Pacific classification yard in Sacramento, which experienced long delays caused by slow moving switching movements and where visibility was often obstructed by standing rail cars on each side of the crossing.

Unlike accidents, delays are not random events, or are statistically insignificant, but are inherent characteristics of crossings in the throat area of railroad yards. The writer recommends BD should continue as a multiplier – not a Special Conditions Factor --- in the formula.

**Minor Changes in Accident History Cause Disproportionate Changes In Priority Ranking**

During the first 30 years of the PUC program, accident history was either disregarded as being statistically insignificant at any specific crossing, or where there was evidence of previous accidents, an appropriate number of points was *added* in the several Special Conditions Factors. Accident history never contributed more than a few points to the total Priority Index Number.

The problem with the present formula is that during the chaos of the 1990 hearings, when the principal goal was to prevent the diversion of all grade separation funds to light rail interests, *multiplication* was substituted in the formula, replacing the former *plus* sign. This substitution, which was not tested in practice, has resulted in accident history becoming decisive in ranking projects on the priority list; all other factors are reduced to secondary or insignificant importance.

Historical background: It is unclear what particular formula was used during the first few years of the program. The 1972 proceedings, Case 9423, computed the traffic factor (V x T), the accident factor, and classified projects according to state of readiness. The final priority list tabulated the projects in numerical order, but without revealing any numerical product.

In 1973 a special committee of grade crossing engineers convened in San Francisco to recommend a grade crossing priority formula. The minutes of the June 7, 1973, meeting of this study group appear in Attachment 1, to which reference should be made. As noted on page 2 of Attachment 1, the general consensus of the committee was that the V x T (vehicles x trains) product was the best measure of possible conflicts. The group further felt that "since the number of accidents at [any] grade crossing is very small, the sample size usually is *too small to be of any statistical value*” (emphasis added). It was agreed that a formula following the general format

$$P = \frac{T \times V}{\text{Cost}} + \text{Summation of Special Conditions Factors (physical site conditions, impacts on the community, etc.)}$$

would give the best configuration.

The formula as revised for the 1974-75 list (Case 9663, Decision 83066), and 1975-76 (Case 9842, Decision 84530), was of the form

$$P = \frac{V \times T}{\text{Cost} \times 24} + \text{Special Conditions Factors (SCF)} \quad \text{[24 was the inflation factor]}$$

SCF included vehicular speed, train speed, crossing geometry, vehicular delay, alternate route, accident history (G6), and irreducibles. The weight given G6 varied from 0 to a maximum of 14 points, with most of the nominations being awarded 6 points or less in a total SCF point score ranging from 5 or 6 to as many as 35. In summary, accident history was only one of several factors contributing to the total Priority Index Number.

Injuries and fatalities do occur, but their pattern is essentially random and rarely due to any inherent deficiency in the crossing itself, but rather because of fog, driving under the influence, brake failure, racing to beat the train, transients sleeping on the track, etc. Like persons killed by lighting, these are random events. There are 10,263 railroad grade crossings in California, at which an average 150 to 160 accidents occur each year – an incidence of only 0.015 accidents per crossing per year. That is, at an average crossing an accident can be expected only once in 67 years. Nevertheless, a pattern of accidents may develop at one crossing, and so the formula usually included accident history as one of the components included in the summation identified as Special Conditions Factors (SCF).

This basic format was followed consistently, with some minor adjustments, prior to the 1989-90 controversy. As previously mentioned, the priority ranking process was thrown into disarray by the 1988 priority list, in which light rail movements were counted equivalent to conventional trains, and a single Southern California transit district captured 8 of the 10 highest-ranking projects in the entire state. The entire priority process was reopened under Investigation 87-10-033, hearings held in 1988, which established the list for 1988-89 and 1989-90. The problem of the light rail movements was resolved by applying a reduction factor of 1/10, that is 10 light rail movements were considered equivalent of one conventional train movement.  Further hearings were held in 1990 under Investigation 89-09-021.  However, in the ensuring confusion other factors in the formula were rearranged, with the result that the statistically insignificant accident history was *multiplied* by (V x T), instead of being a simple additive factor, as had always previously been the case.  As a result of this mathematically questionable and untested substitution of a x (multiplication) sign for a + (plus) sign, the presence or absence of accidents at individual crossings, representative samples of which are " usually too small to be of any statistical value," in effect has determined whether a project will rank sufficiently high to be funded.

Of the 24 highest priority projects ranked under Decision 00-08-020, there were only three at which no accidents had occurred, and all three were essentially consolidations involving multiple crossings or alternates to the same nominations.  A similar result occurred under Decision 98-06-072, after disregarding one project which had submitted an unrealistically low cost estimate.

Consequently, local agencies have discovered that the only crossings which have any reasonable odds of receiving state aid were those where one or more accidents have occurred within the prior decade.  An inebriated motorist returning from a bar might randomly select Boulevard A to crash into a train, although he might equally have blundered down Boulevard B.  With the formula's overwhelmingly dominant focus on accidents, Boulevard A ranks high on the priority list, while Boulevard B gravitates towards the bottom, notwithstanding that all other factors – geometrics, number of trains, speeds, vehicular traffic volumes, delays, etc. – may be substantially identical.

Should the position on the priority list, which in turn may determine whether or not the separation is built, be so excessively dependent on the details of a single incident?  Was the victim really injured, or merely taken to the hospital for observation?  Or did he die from his injuries?  If he did die, was it from the train accident or other causes?  The local agency may be motivated to follow the ambulance to the hospital and collect reports to strengthen a nomination.

The writer recalls a nomination of the City of Fremont. A pedestrian was injured in the vicinity of one crossing. Because the outcome of the present formula is so critically dependent on the statistically unreliable and erratic accident history, a lively debate developed at the hearings as to whether the incident occurred within reasonable distance of the grade crossing, and whether it was a suicide attempt.

Whatever may be the answers to these questions, the writer contends they should not be decisive in determining whether the grade crossing should or should not be awarded a high position, although the incident should not be ignored. The present formula gives far greater weight to these details than an increase of several thousands of vehicles per day or to a substantial increase in the number of trains.

Examples showing how a small change in the accident history at a grade crossing can cause drastic and abrupt changes in the priority ranking is illustrated by the two hypothetical proposed underpasses, at Apple Street and Baker Street.

Apple Street: 12,000 vehicles, 30 trains, $4 million cost, one recent accident generating 3 points, average delay 2 minutes, summation of Special Conditions Factors = 25 points. Apple Street would receive priority Index Number 79, and rank about No. 13 on last year's Priority List.

Baker Street: Identical traffic and train volumes, cost, average delay, and summation of Special Conditions Factors same as for Apple Street. The only difference is that no accident has occurred at Baker Street during the last ten years. Baker Street receives priority Index No. 47, and drops far down in the ranking, to No. 25.

If the 3-point accident had occurred at Baker Street instead of Apple Street, then the priority positions are reversed. Or if a review of the accident history reveals that the 3-point accident at Apple Street occurred 11 instead of 10 years ago, then Apple Street drops to No. 25. Conversely, if a new accident occurs at Baker Street, it may suddenly ascend toward the top of the list.

To have the same impact on the priority position as the one accident, vehicular traffic would have to skyrocket from 12,000 to 30,000 vehicles per day.

Consider the proposed South Street separation in Redding, where 12,405 vpd cross the Union Pacific mainline, and where each train movement delays traffic for over 3 minutes. However, there were no accidents, and this separation received the very disappointing Priority Ranking of No. 35 – far below any opportunity for receiving funding. However, if a single fatal accident had occurred, the separation would have received priority index number 72.25, and would have ranked No. 12 State-wide on the Priority List

Although accidents are important criteria, and the PUC staff cannot be expected to research historical records towards antiquity, the examples just cited illustrate that the accident record as applied in the present formula dominates the priority process, and that the formula operates to exclude those grade crossings which have a clean accident record from participation in the PUC program. Why waste staff time and money to submit a nomination and attend hearings if one realistically can expect to receive a priority position no higher than number 22 or 25?

Should the PUC continue the misleading and deceptive practice and invite local agencies to submit nominations, when its flawed formula effectively disqualifies those where no accidents have occurred?

## Grade Separations To Replace Proposed Grade Crossings Are Relegated To The Bottom Of The List, Contrary To Legislative Intent And Earlier Commission Decisions

In 1971 the legislature enacted three bills, (AB 1587, AB 388, and SB 141) (Chapter 1602, California Statutes, 1971; amended Chap. 1232, 1602 and 1798), which for the first time qualified a new category of "proposed" crossings, that is, no existing crossing to be closed. In accordance with this new legislation, the Commission reopened Case No. 9257 by Decision 79775, Feb. 25, 1972, for the limited purpose of accepting nominations of "proposed" crossings. An amended priority list was issued under Decision 80079, May 18, 1972, which included seven "proposed" grade crossings.

The new legislation was carefully drafted to discourage but not prohibit local agencies from proposing projects that did not close existing crossings. The aid from the grade separation fund is strictly limited. The maximum allocation for a "proposed" crossing is

50 percent of the estimated cost, as compared to 80 percent for a project which eliminates an existing crossing [Ref. Sect. 2454(b) S&H Code]. Moreover, the Railroad is not required to contribute [Ref., Sect. 1202.5(a) PUC Code]. Consequently, an agency planning, for example, a $5 million separation must defray 50 percent of the cost from local sources; whereas only $500,000 (10 percent) of local money for a project which eliminates an existing crossing, with $4 million from the Grade Separation Fund and $500,000 from the Railroad.

In the 17 priority Decisions issued between 1973 and 1998, “proposed” crossings were evaluated on an equal basis with existing crossings. Their relative priority positions were interspersed among Nominations for existing crossings, based on comparative, vehicular traffic, train counts, cost, crossing geometrics, and other criteria. Two examples of “proposed” projects which received allocations illustrate the benefits of this particular Category.

The Grove Ave. Underpass in Ontario closed the gap in a major boulevard, which now carries some 15,000 vehicles per day. Much of that traffic previously crossed the former Southern Pacific at Vineyard Avenue, which until opening of the new passenger terminal in 1998, was the principal entrance to the Ontario International Airport and was a notorious source of congestion, train delays and hazards to vehicles entering and leaving the Airport.

The Paseo Padre Parkway Underpass in Fremont again closed a gap in a major boulevard, diverting traffic from several grade crossings on torturous and circuitous routes through downtown Fremont.

However, the 1989 formula revisions in effect nullified the intention of the legislature to qualify such projects. As a result, under the present flawed formula there is no realistic opportunity whatever for such projects ever to receive funding. The product, as explained under “Accident History” in the equation

$$\frac{V \times T}{C \times F} \quad (AH + Delays)$$

is always a very small, because no accidents have occurred at the proposed crossings, although crossings from which traffic was diverted may have experienced numerous accidents. The practical effect of a formula that places all “proposed” crossing projects at the bottom of the list excludes them from participation under the Grade Separation Program. It is not believed that any "proposed" project has ever received an allocation under the current formula, because it is mathematically impossible to obtain a "reachable" position.

There are persuasive reasons for including proposed crossings, particularly in the fringes of the State's rapidly growing metropolitan areas – where the inadequate network of former rural roads demands additional crossings of the railroad barrier to meet exploding traffic needs.

However, whatever may be the merits of such "proposed" crossings or the above arguments, it is not the purpose of this discussion to debate the issue, but rather to reiterate that the methodology should help implement and not subvert the legislative intent as expressed in the three 1971 bills. Had the legislature intended that proposed crossings should be financed <u>only</u> after all existing grade crossings have been separated, then it could well have adopted appropriate language, such as found in the <u>Streets & Highway Code,</u> which defers funding of certain freeways until others are completed.

**Use Of Irrelevant Factor in Formula for Alteration or Reconstruction of Existing Separations Yields Illogical Results**

The priority lists established under Sect. 2452 include existing separations in need of "alteration or reconstruction". The present formula is:

$$P= \frac{V \times (T + 0.1\ LRT)}{\text{Cost} \times \text{Inflation Factor } (8.32)} + SF \text{ (Separation Factor)}$$

Once an underpass or overpass is in place, obviously all train/vehicle grade crossing conflicts disappear. Remaining hazards to the travelling public are caused by constricted or narrow roadways between supporting columns, substandard vertical clearances, structural inadequacy, dangerous sharp approaches, and the like -- not by the number of train movements.

Consider an analogous situation: Since hazards to the public for a bridge crossing a stream or irrigation canal are a function of traffic volume, its narrow width, and/or structural condition, it is immaterial whether the stream or irrigation canal is dry or carries some water – the latter factors are disregarded when deciding to widen or replace the structure.  Similarly, the number of trains should be disregarded in the priority formula for existing separations.

At the Harbor Street Underpass in Pittsburg, one of the 1989 Nominations, traffic on the broad, four-lane divided boulevard approaches was forced to squeeze down through a narrow, antique two-lane underpass.  The hazards, congestion, and inconvenience to motorists in Pittsburg were in no way affected by whether Southern Pacific operated four, 40, or 140 trains across the structure.

Or consider this hypothetical example: A County highway crosses two separate railroads which follow parallel alignments, the highway being carried on separate structures over each railroad.  The two overpasses are about 100 yards apart, substantially identical, each only 20 ft. wide, and each dangerously narrow and clearly in need of widening. Vehicular traffic is about 10,000 vehicles per day. Numerous accidents caused by the narrow width at each structure have occurred.  Railroad ABC carries four trains per day; Railroad XYZ 40 trains per day.

The writer contends, therefore, that both structures should receive the same Priority Index Number, irrespective of the difference in number of train movements.  That factor is entirely irrelevant to motorist's safety, and should be entirely disregarded in formulating a list of structures “most urgently in need of alteration or reconstruction”.

The narrow Capitol Avenue Underpass in West Sacramento has impaired vertical and horizontal clearances, and chunks of concrete are likely to drop onto oncoming vehicles. Unfortunately, only six switching movements operate per day, and this structure ranks toward the bottom of the priority list.  If there had been twice as many switching movements, that is, 12 instead of six, the project would have received a priority index number of 70.54 and a Priority Ranking of No. 13.

The (T + 0.1 LRT) term in the formula should be removed and replaced by a uniform constant so that the computer output can more accurately identify those separations "most urgently in need of alteration or reconstruction”.

## State of Readiness

In the early years of the PUC Program, those projects in a higher "state of readiness" were arbitrarily awarded higher priority positions. The earlier policy recognized the prior investment and engineering effort of local agencies to reserve or acquire rights-of-way, and to aggressively pursue preliminary or final engineering plans, as compared to other agencies which had undertaken no serious preliminary efforts whatever. Unfortunately this policy was discontinued. In a few instances a local agency had completed engineering plans ready for advertising, fully expecting to receive an allocation, but higher-ranking projects depleted the grade separation fund. Then, during the renomination process -- due to a small seasonal decline in rail traffic, the fact that an accident record became more than 10 years old, or some other change -- the agency did not receive a "reachable" position on the following year's list, and thus original investment of as much as $200,000 to $300,000 was lost.

Inclusion of a "State of Readiness" factor would help preserve prior investments made by local agencies in engineering and right-of-way, and help maintain continuity in the highway planning process. For example, Fresno County (Chesnut Avenue Overhead) and City of Ventura (Johnson Drive Underpass) both had substantially completed engineering plans, both had received PUC Orders authorizing construction, and both had executed C&M Railroad Agreements. To avoid potential waste of public funds, such agencies should be given special consideration on the following year's list. A suggestion is offered in PART TWO to alleviate this problem.

## Summary of Formula Shortcomings and Defects

The foregoing examples indicate that:

- The use of **average delays** (BD) penalizes those agencies which experience a mixture of slow-moving long trains and numerous short trains or locomotive helper units
- The **accident history** factor, which the 1973 Priority Criteria Study Group stated *lacked any statistical value*, has an excessive and decisive influence on the final priority position, to the subordination of all other factors. Small changes in accident experience can help catapult an average crossing to a high position, or cause it to drop to an abnormally low ranking. It is almost as if rational highway planning to meet overall community transportation needs is displaced by a frantic scramble to sift through accident records and chase ambulances. Was the pedestrian killed by a train

within the proper distance from the crossing to be included in the PUC's crossings statistics? Or was he a suicide? Should the answers to these questions, which under the present formula can either boost the crossing to a high position or make it unreachable, be decisive in allocating scarce grade separation funds? In summary, the present formula essentially takes *risk of accident* (expressed as vehicles x trains) multiplied by *accident history*, and then adds several Special Conditions Factors, which attempt to quantify *increased accident potential*. In other words, *accident risk x accident history + accident potential,* which grossly exaggerates the accident components of the formula.

- The fact that the number of trains, vehicular traffic volumes, or project costs are largely ignored by the formula for **projects to eliminate proposed crossings**, however meritorious, effectively deprives local agencies from qualifying under the grade separation program. Although legislation was specifically enacted to qualify proposed projects, the present formula makes it mathematically impractical for such projects to compete, nullifying the legislation.
- For **existing separations** in need of alteration or reconstruction, where the only issues are inadequate traffic capacity, substandard clearances, poor structural condition, or physical safety hazards to vehicular traffic, inclusion of the entirely irrelevant factor of number of train movements in the formula prevents projects where there are only a few train movements from participating in the PUC program.

## PART TWO: RECOMMENDED FORMULAE REVISIONS

The writer offers the following recommendations to remedy the shortcomings of the two formulae:

FOR PROJECTS TO ELIMINATE EXISTING OR PROPOSED CROSSINGS, reinstate the basic formula recommended by the 1973 Committee and (with refinements) used successfully from the1960’s through 1989, but with certain adjustments, viz:.

- Multiply light rail movements (LRT) by the 1/10 (0.1) reduction factor, the most significant reform adopted in 1990, and as contained in the present formula.

- Revise the method of computing Blocking Delay (BD), to remedy the mathematical fallacy of using <u>average</u> delays, as described in PART ONE. It is recommended that the total minutes of delay per day be divided by an arbitrary constant of 10 rather than by the number of train movements. Example: Crossing blocked for 134 min during 24 hours, divide by 10, thereby generating BD of 13.

- Increase the maximum number of points available under Other Factors (OF) -- geometrics, school buses, hazardous materials, emergency vehicles, etc. -- from 17 to 20. The objective: To give greater weight to the judgement of the Commission's engineering field staff, who inspect each of the nominated crossings. The priority process should take advantage of their invaluable professional experience, and permit the staff to increase the points at sites where they observe unusual hazardous conditions which are not adequately addressed in the mathematical formula

- Add “State of Readiness” points, on a sliding scale somewhat as follows:
  - 0 points -- where no geometric studies have been developed
  - 5 points -- preliminary studies and geometric layouts well advanced
  - 10 points -- where formal PUC Application for permission to construct has been filed, an Order has been issued, and a Construction and Maintenance Agreement with the Railroad has been executed
  - 15 points -- where final design plans, specifications and estimates have been substantially completed, and as much as 50 percent of the needed right-of-way has been acquired or in negotiation.

The writer agrees with the basic conclusions of the 1973 Priority Criteria Study Group that the several considerations "reduce to Primary and Secondary factors to be included in a priority formula." The **Primary Factors** are:

- Train Volume (T)
- Vehicular Volume (V)
- Cost (C)

The writer proposes to also include delays (BD) as a primary factor, that is, a multiplier and as included in the present formula.

The **Secondary Factors** essentially include those used in the present formula, except the writer proposes to add Accident History (which 1973 group had disregarded), and the State of Readiness, both to be included in the summation of Special Conditions Factors (SCF).

To assure a relative balance, the writer agrees with the 1973 group that the Primary Factors $\frac{V \times T}{C}$ should dominate, and that the sum of the Special Conditions Factors should not exceed 20 to 30 percent of the total. In other words, the "tail should not wag the dog."

In reviewing the 20 highest-ranking nominations submitted in 1999, the total of SCF factors, (with the additions proposed by the writer), range from 32 to 90.
The $\frac{V \times T}{F \times C}$ component of the same 20 nominations varied from 151 to 18.
To assure that primary factors will dominate over secondary (SCF) factors, the writer proposes that $\frac{V \times T}{F \times C}$ then be multiplied by 10.

The inflation factor F, 8.32 for the most recent proceeding, would continue to be applied as in the past.

The recommended formula is

$$P = \frac{10\ V \times (T + 0.1\ LRT) \times BD}{C \times F} + \text{Special Conditions Factors}$$

The Special Conditions Factors would include the several components enumerated in the present Investigation and in the Introduction, and also add (not multiply) AR (accident history), and State of Readiness (S of R), each as separate additive components.

FOR PROJECTS TO ALTER OR RECONSTRUCT EXISTING SEPARATIONS, with certain exceptions, retain the present formula. For light rail movements at existing separations, the 1/10 reduction factor would continue to apply, as described previously and as in the present formula. Changes proposed are:

- Eliminate number-of-trains factor, for the reasons outlined in PART ONE
- State of Readiness – Add points, as recommended previously for projects to eliminate existing crossings.

The recommended formula is

$$P = \frac{V \times \text{Constant}}{C \times F} + \text{Separation Factor} + \text{S of R}$$

Where P = priority index number
Where S of R = State of Readiness (0 to 15 points maximum)

The constant would be an arbitrary fixed number to assure the reconstruction projects are awarded priority point of approximately the same order of magnitude as projects to eliminate existing grade crossings, although it is difficult to compare apples and oranges.

The Separation Factor would continue to be computed as described in Decision 00-08-020.

## Verification

I am the interested party in the above-entitled matter; the statements in the foregoing document are true of my own knowledge, except as to matters which are therein stated on information or belief, and as to those matters I believe them to be true.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on October 22, 1999 at San Francisco, California

______________________________________

Robert M. Barton, P.E.
Interested Party

**PROOF OF SERVICE – CCP SECT. 1013a, 2015.5**

I declare that:

I am over the age of eighteen years and not a party to the within cause; my business address is Parsons Transportation Group Inc., 120 Howard Street, Suite 850, San Francisco, California 94105.

On October 22, I served the within COMMENTS ON RAILROAD GRADE CROSSING PROJECT PRIORITY FORMULA on the interested parties in said cause by placing a true copy thereof enclosed in a sealed envelope with postage thereon fully prepaid, to be placed in the United States mail, and addressed as follows:

**(SEE ATTACHED LIST)**

I declare under penalty of perjury that the foregoing is true and correct and that this declaration was executed on October 20, 1999, at San Francisco, California.

Signed:

___________________________________